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PRELIMINARY REPORT
WHITE PINE BLISTER RUST INCIDENCE SURVEY

1966 and 1967

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U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
Division of State and Private Forestry
Region 1

Missoula, Montana

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PRELIMINARY REPORT
WHITE PINE BLISTER RUST INCIDENCE SURVEY

1966 and 1967

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INTRODUCTION

Early in 1966 plans were formulated by the Pest Control Branch, Division of State and Private Forestry, Region 1, for an intensive evaluation of the effectiveness of ribes eradication as a control measure for white pine blister rust (Cronartium ribicola). This disease completes its life cycle on two plant species; the aecial and pycnial stages on white pine (Pinus monticola) and the telial, uredial, and basidial on Ribes species. Past control efforts were based on limited spread of the spores and the assumption that if the alternate host Ribes was removed within and adjacent to stands of white pine, the incidence of infection would be greatly reduced. On this basis, a ribes eradication program was initiated in western Montana, northern Idaho, and eastern Washington that, until 1967, persisted for over 30 years. Results of the program have been questioned several times; in many stands the ribes population had been reduced to less than one bush per acre but new infection was still occurring. However, these casual observations were not supported by reliable data. Subsequently, a survey was designed to accurately evaluate ribes eradication as a control for blister rust. Field work was done during the summers of 1966 and 1967 and data was combined for both years for analytical purposes.

METHODS AND MATERIALS

The sampling method designed by Clutter (1966) was used to estimate the proportion of white pine trees infected with blister rust and the average number of infections per tree within individual stands. Briefly, it consists of double sampling, once by a cluster technique and once by single tree plots called "detail" trees. Both were distributed evenly throughout the stand. The cluster, in which only presence of infection was noted, was used to estimate proportion infected; the detail, in which number and age of each infection was noted, was used to estimate average infections per tree. Within a stand, 28 clusters of 20 trees each, and 84 detail trees were sampled; thus, 644 trees were sampled per stand. It was permissible to conduct both sampling methods simultaneously, and three detail trees were sampled in conjunction with, but separate from, each cluster.

Stands had to meet the following criteria before they were considered for the survey: (1) at least 40 acres in size, (2) have 50 or more dominant and codominant white pine trees per acre, and (3) be at least 4 years old.

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EXPERIMENT STATION

A history of ribes eradication, including number and date of each eradication type (complete, partial, or stream), number of ribes removed per acre, and results of status checks within the last 3 years, was obtained for each stand surveyed. Stands were not selected on the basis of specific site characteristics.

Nearly all field work was done by Forest personnel, and data analysis was completed by Pest Control.

RESULTS

One hundred and six stands were surveyed ranging from 4 to 62 years of age. This represents a total of 68,264 trees sampled, 59,360 cluster trees, and 8,904 detail. The number of stands sampled per Forest were:

Forest	Stands sampled
Clearwater	20
Colville	1
Coeur d'Alene	31
Kaniksu	17
Kootenai	6
St. Joe	31

It should be noted that this survey was designed to estimate the relationship between ribes eradication and infection rate, and does not necessarily imply very much concerning the actual damage that has occurred in the pine stands surveyed.

The relationship of proportion of trees infected to stand age is shown in figure 1 (App.). All stands surveyed are represented on this graph, and have had from 0 to 8 eradications with 1 to 1,000 ribes removed per acre. Even with the extremely variable history of the individual stands, a fairly constant relationship is observed between age and proportion infected, suggesting that ribes eradication was not effective. From the curvilinear relationship which most accurately represents the data, it is seen that a stand 15 years of age can be expected to be 40 percent infected, while a stand 40 years old will be 92 percent infected. From 2 to 40 years a stand will have an average of 3 percent infection per year. The correlation coefficient (r) of .549 implies fair association between stand age and proportion infected.

The relationship of average number of infections per tree to stand age is shown in figure 2 (App.). Average infections increase constantly up to age 30, but then accelerate instead of leveling off as did proportion infected. Again, the high association of stands below 30 years of age, having an extremely variable eradication history, suggests little effectiveness. As a stand increases in age, amount of foliage also increases and presents a larger target for the spores, thus increasing the probability of infection. This may explain the upward turn of the curve.

Figure 3 (App.), represents the relationship between ribes per acre removed during an eradication, to the number of infections occurring in the 2-year period preceding the eradication. Theoretically, the higher ribes populations should effect a higher number of infections, but the data does not support this hypothesis. The correlation is slightly negative, indicating that ribes per acre within a stand may not be related to the number of infections occurring in that stand.

The average number of infections occurring in the 2-year period before eradication for 135 eradications was 12.86 compared to 15.29 after. Because of the variation present, these values are probably not significantly different; surely an eradication shouldn't increase infection.

A comparison of stands in which eradication was not done to those which have been eradicated, in relation to proportion infected, is shown in figure 4 (App.). The average number of ribes removed per eradication is also shown for each stand. Only four control stands were surveyed; one 29 years old, two 33, and one 43. All eradicated stands within these age groups are shown for comparison. Eradication again has not had any great effect in reducing the proportion infected.

DISCUSSION AND CONCLUSIONS

The ribes eradication program in the Intermountain area has been relatively ineffective and its continuance cannot be justified on a biological basis. In some stands eradication efforts may have influenced infection enough so they will survive for a few years longer than if no eradication had been done, but in most stands the infection rate was not altered.

The ribes eradication program was based on the assumption that blister rust spores could not be wind transported in a viable state for more than a few chains. Most likely the number of spores produced within and adjacent to a stand was reduced by the eradication efforts. The most likely explanation for the ineffectiveness of the eradication is that long distance transfer of viable spores does occur; also, microclimatic variations may account, at least in part, for the variability found. Another possibility is that the survey was not accurate, and the data is false. Statistically this could happen only five time in a hundred, and one can be 95 percent reasonably sure the data is reliable.

It is concluded that eradication of ribes, as done in the past, is not an effective method of control of white pine blister rust in the northwest Intermountain Region. A more thorough understanding of the etiology of the disease must be attained before any control method can be effected.

FIGURE-1

WHITE PINE BLISTER RUST INCIDENCE SURVEY

RELATION OF PROPORTION INFECTED TO STAND AGE

DATA FROM 106 STANDS

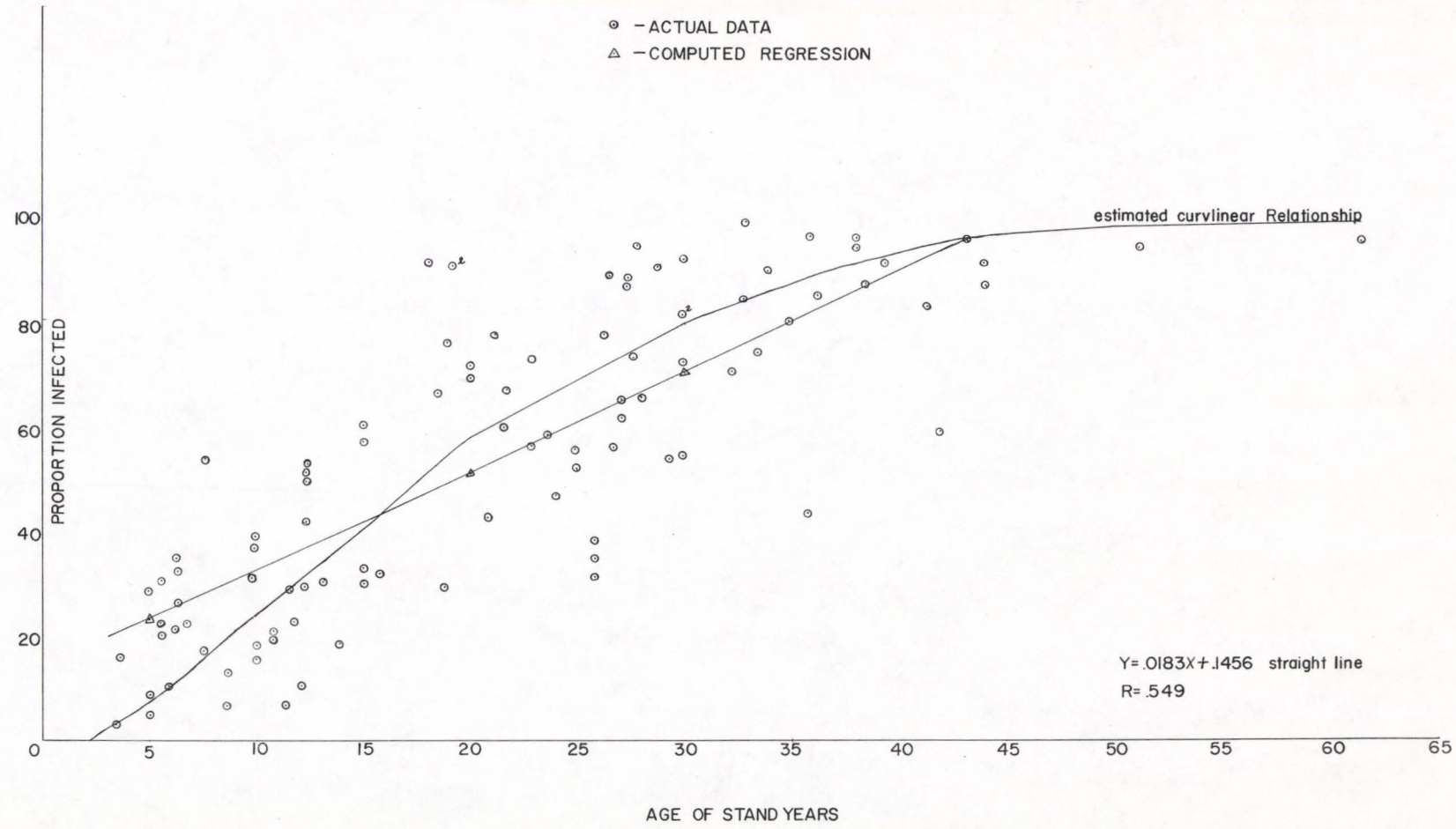

FIGURE - 2

WHITE PINE BLISTER RUST INCIDENCE SURVEY

RELATION OF NUMBER OF INFECTIONS PER TREE IN THE STAND TO STAND AGE, YEARS. DATA FROM 106 STANDS

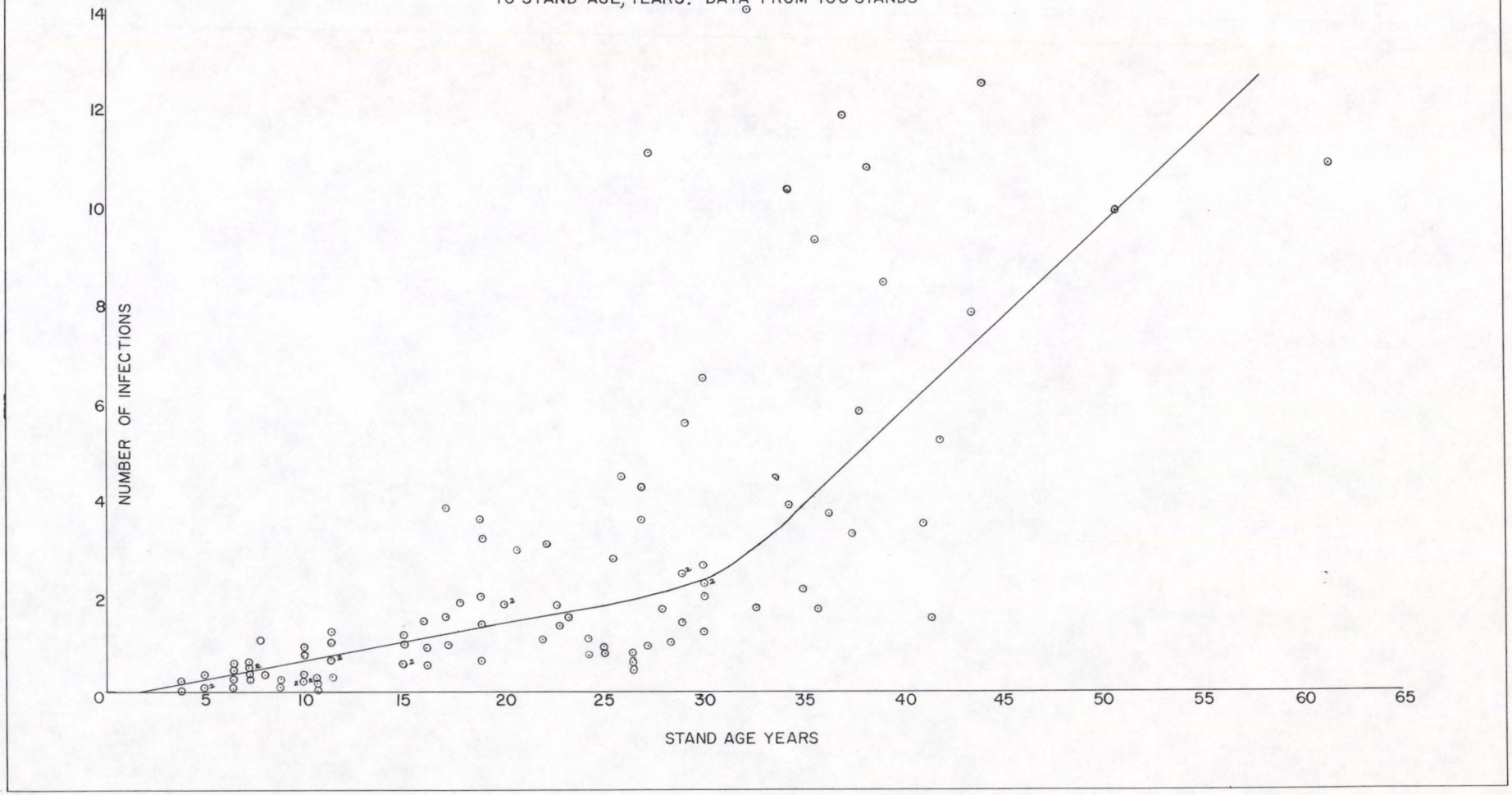

FIGURE – 3

RELATION OF RIBES PER ACRE TO INFECTION

RELATIONSHIP OF RIBES PER ACRE, REMOVED AT ERADICATION, TO NUMBER OF INFECTIONS IN THE 2 YEAR PERIOD PRECEDING THE ERADICATION. DATA FROM 135 ERADICATIONS

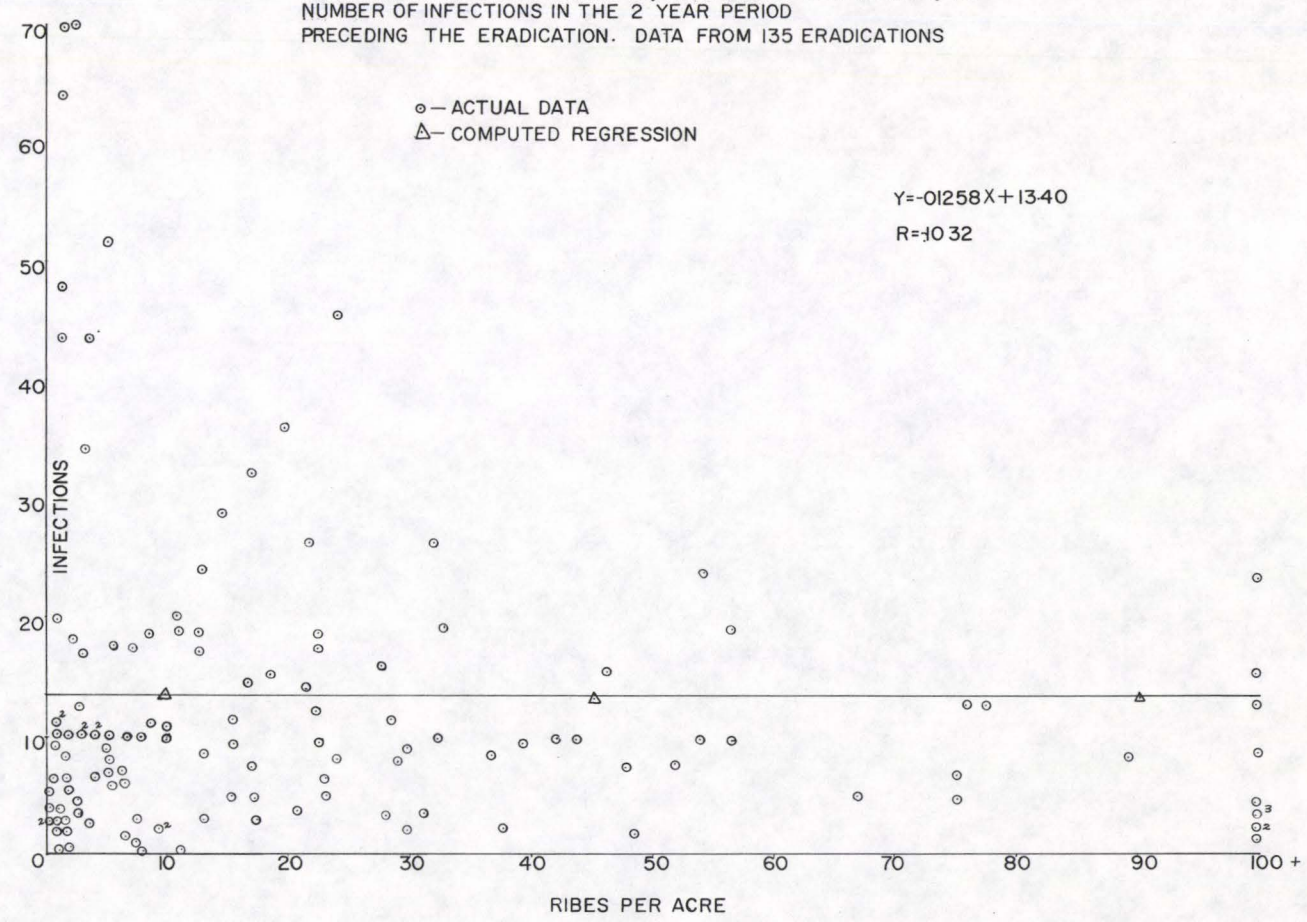

FIGURE-4

EFFECT OF RIBES ERADICATION ON PROPORTION INFECTED ($\hat{PI}$)